Digital Skill Proficiency and Data Analytical Usage among Public-Sector Internal Auditors of the Accountant General's Department of Malaysia: Advancing Audit Digitalisation

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Abstract

Purpose: The current study aims to explore the level of digital skill proficiency among public-sector internal auditors of the Accountant General's Department (AGD) of Malaysia and examine the degree of data analytical usage among the auditors.

Method/ Design/ Approach: An online survey questionnaire was employed to gather data from a population of 124 public-sector internal auditors from the Internal Audit Management Division (BPAD) of the AGD Malaysia. Descriptive statistics, including mean scores, standard deviation, and mean score ranking, were utilised to determine the level of digital skill proficiency and data analytical usage. In addition, a focus group discussion was conducted with AGD officers to support the statistical findings.

Findings: The results revealed that public-sector internal auditors averagely possessed moderate levels of digital skill proficiency, with limited data analytics types. Microsoft Excel was the most extensively employed software among the auditors.

Originality: The empirical findings contributed novel insights into the current levels of digital skill proficiency and data analytical usage, which served as a valuable foundation for developing targeted strategies to advance the digital audit transformation agenda.

Keywords: Digital skills, data analytics, proficiency, public sector, auditors

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1.0 Introduction

Technological advancements, such as artificial intelligence (AI), robotic process automation (RPA), data analytics, and cloud computing, have significantly revolutionised the traditional auditing processes (Huang & Vasaehelyi, 2019; Otia & Bracci, 2022). Leading global accounting firms, including Deloitte, Ernst and Young, KPMG, and PwC, have performed significant investments in technological advancements to enhance efficiency and effectiveness (McGowan, 2023). Simultaneously, automation tools can facilitate the automation of monotonous tasks, which allows auditors to focus more on more complex activities, such as strategic analysis and risk assessment (Kelly, 2020; Moffitt et al., 2018; Tiberius & Hirth, 2019). Relevant Al-powered instruments and advanced data analytical techniques can also analyse large data volumes efficiently and accurately to identify patterns and anomalies previously undetected through manual audit processes (Huang & Vasaehelyi, 2019; Kokina & Davenport, 2017; Otia & Bracci, 2022). Moreover, the adoption of cloud computing improves flexibility and responsiveness by enabling real-time data access and remote collaboration (Alles & Gray, 2016; Garg et al., 2020; Otia & Bracci, 2022). Collectively, the aforementioned technological advancements necessitate auditors to continuously adapt and upskill to effectively leverage the technologies (ACCA, 2020).

Malaysia has actively been pursuing digital transformations since the establishment of the Multimedia Super Corridor (MSC) in 1996, which has acted as the foundation for subsequent developments in digital technology and infrastructure. The Malaysia Digital Economy Blueprint (MyDIGITAL) introduced in 2021 is a key example of the governmental commitment to accelerating national progress towards a digitally driven and high-income nation by 2030. The government has emphasised digital transformation as a significant driver of revolutionising the operations and service delivery of public-sector organisations. Furthermore, conventional auditing processes are becoming insufficient when more contemporary processes and systems are increasingly digitalised, which poses a considerable concern, especially for internal auditing in evaluating organisational performance (Pizzi et al., 2021). The BPAD is responsible for internal audits on public-sector entities, with a primary focus on financial and compliance audits. Accordingly, BPAD auditors should keep abreast with the latest technological advancements to ensure transparency, integrity, and high service quality among governmental agencies when allocating and utilising public funds. Thoroughly understanding the current level of digital skill proficiency and data analytical usage among BPAD internal auditors is imperative to guarantee that the auditors are adequately equipped with the necessary skills and can effectively utilise available data analytical techniques and tools. Low digital skill proficiency may hinder the auditors' preparedness to swiftly adapt to a data-driven audit environment (Ismail et al., 2024). Taib et al. (2023) also emphasised the importance of addressing competency gaps to improve the effectiveness of digitalisation.

The current study seeks to explore the level of digital skill proficiency and assess the degree of data analytical usage among BPAD internal auditors. The study would contribute significant insights and advance the existing knowledge corpus on digital audit transformation by elevating the understanding of how public sector auditors could adapt to the evolving digital landscape. Specifically, the findings would offer valuable insights for developing targeted capacity-building initiatives and enable authorities to design structured training programmes to effectively bridge digital skill gaps. Furthermore, the present study could support audit institutions in optimising digital strategies to enhance audit efficiency, strengthen fraud detection, and improve risk

assessment in public-sector audits. The results could also indicate the preparedness level of public-sector auditors to embrace and adapt to the digital future. The following section delineates the study background and literature review, followed by the employed methodology, findings and discussions, and the section on implications, limitations and future directions.

2.0 Background and Literature Review

2.1 Development and the Current Status of Digital Audit Implementation

The AGD Malaysia has pledged commitments towards the Malaysian governmental digital transformation agenda and materialising the MyDIGITAL initiatives through the establishment of the ICT Strategic Plan (2019–2023). The top management of the AGD has consistently elucidated the future directions towards higher digitalisation of the work processes, especially the BPAD. The division under the AGD initiated the digitalisation journey in 2018 by developing an integrated audit system, namely the Integrated Audit Report and Feedback Management System (iAREF). The system was fully activated on September 9, 2022, and the BPAD further reinforced the implementation of digital audits during the coronavirus disease (COVID-19) pandemic in 2020 as physical audit processes were unfeasible owing to the restrictions imposed by the movement control order (MCO) by utilising available digital resources and technological capabilities. Nonetheless, the iAREF is not integrated with other systems as the system only consolidates all audit engagement working papers for preparing the audit report. The system manages the entire process from the letter of intent to execute the audit work to reporting and monitoring. The iAREF encompasses a self-assessment (penilaian kendiri) audit, which is highly recommended in the standards stipulated by the International Organisation of Supreme Audit Institutions (INTOSAI) (2023). Currently, the system is undergoing a maintenance phase for one year. The development of the iAREF highlights the AGD commitment, particularly from the BPAD, to incorporate digital aspects into daily operational processes.

The BPAD management has implemented various initiatives to generate higher awareness among auditors regarding digital audit implementation and improve the auditors' competencies in employing digital tools for audit work. In addition to Microsoft Excel, the BPAD has invested in a specialised audit analytics tool recognised as Audit Command Language (ACL), which can analyse data for the entire population and identify anomalies or red flags that indicate potential risk areas. Contemporarily, the division comprises a permanent staff member who is well-versed in ACL. The assistance from the ACL vendor, scripts, or instructions for the financial statement items, namely Liability, Equity, Expenditure, Asset, and Revenue (LEBAH) have also been developed. The ACL output will be manually transferred to the iAREF for reporting and monitoring purposes. Nevertheless, ACL operates only within the governmental accounting system, namely the Integrated Government Financial Management Accounting System (iGFMAS), with the limitation in extracting data from sources other than iGFMAS. The limitation has prompted the department to explore more advanced audit analytical tools, in which the potential adoption of the Python programming language has been agreed upon in 2020 Business Strategy Planning (BSP) by the BPAD. A working paper has been prepared by a team in the BPAD and approval has been received from the Trust Fund unit in 2022 before the procurement process for the Python programming language has been initiated in late 2023.

2.2 Literature Review on Digital Skill Proficiency and Data Analytical Usage

A digitalised business environment significantly impacts audit practices and auditors' daily tasks (Betti & Sarens, 2021; Felski, 2023; Ferreira et al., 2021). Transitioning to digital audits necessitates auditors to possess adequate digital or information technology (IT) skills in terms of relevant applications, tools, and techniques (ACCA, 2020; Muro, 2017; Otia & Bracci, 2022; Taib et al., 2023). Digital skills, competencies, or literacy refer to the capability to effectively utilise digital tools and technologies, which encompasses proficiencies related to computers, software applications, the internet, and other digital resources (Barac et al., 2021; Ifada & Komara, 2023; Lutfi et al., 2023; Tsiligiris & Bowyer, 2021). Auditors are also required to be proficient in data analytical tools, familiar with automated auditing software, and skilled in cybersecurity practices to protect sensitive financial data when cybersecurity has become an increasingly critical aspect of digital audit and financial transactions are contemporarily more vulnerable to cyber threats and data breaches (Haapamäki & Sihvonen, 2019; Slapničar et al., 2022). The growing risk requires auditors to be well-versed in technology risk management (KPMG, 2024). Additionally, thoroughly comprehending cloud computing for storing and accessing audit data and employing advanced Excel functions for data manipulation are essential digital skills in modern auditing (Bahador & Haider, 2013; Pilos, 2020; Richardson et al., 2023). The skills are vital to auditors to efficiently perform tasks (Al-Okaily et al., 2020; Algudah et al., 2020; Aryanti & Adhariani, 2020; Holmes & Douglass, 2022; Vitali & Giuliani, 2024).

Data analytics is increasingly integral to digital audits and is highly related to digital skills (Pilos, 2020), which involves identifying business questions and challenges that can be addressed through data analysis (Richardson et al., 2023). Data analytics is pivotal to enabling effective data processing, which can be transformed into valuable insights imperative to informed decisions, supporting corporate processes, and improving customer experience (Gandomi & Haider, 2015; Gartner, 2024). Moreover, data analytical tools, such as ACL and Python programming, have allowed auditors to conduct more thorough, accurate, and efficient audits (Betti & Sarens, 2021; Felski, 2023). The application of big data and data analytics has also produced numerous benefits in the public sector, including enhancing the quality of audit engagements through clearer and more comprehensible insights into public-sector entities and allowing for data testing of the entire population (Earley, 2015). Data analytics also facilitates the process of identifying emerging trends and anomalies, supports risk assessment, and aids in fraud detection, which can enhance governmental accountability and transparency in public-sector auditing (Kelly, 2020; Lazarevska et al., 2022).

Data analytical usage can be categorised into four general types, namely descriptive, diagnostic, predictive, and prescriptive (Barr-Pulliam et al., 2022; Richardson et al., 2023; Sigma, 2021). Descriptive analysis is performed to understand the environment by graphically presenting data insights via charts and graphs for more comprehensible information. Diagnostic analysis assists in data comparison to thoroughly understand causes and correlations while offering deeper insights into the causes of certain occurrences. Predictive analytics aids in forecasting future trends by incorporating advanced statistical models and machine learning algorithms. For example, integrating audit automation within departments can foster proactive audit approaches and elevate the efficiency and accuracy of audits (Kuenkaikaew & Vasarhelyi, 2013; Richardson et al., 2023). Prescriptive analytics can assist in determining the most appropriate direction for the future, although the analytical method is the most complex form of performing predictions to recommend specific actions (Richardson et al., 2023). The approach requires

auditors to guide respective teams based on data-driven insights and optimise decision-making processes (Sigma, 2021). Each type yields distinct outcomes and uniquely contributes to data-driven strategies and operational improvements.

Data mastering or extraction, transformation, and loading (ETL) encapsulates preparing data for analysis through a series of processes (Richardson et al., 2023). Data must be identified and corrected for errors, missing information, and duplicates before data can be loaded into a specific instrument (Chu et al., 2015). Cleaning and preparing datasets for analysis is one of the most challenging aspects of data analytics (Krishnan et al., 2016). According to the definition of Google Cloud, ETL is the end-to-end process by which a company manages and transforms structured and unstructured data into useful datasets for business purposes (Google Cloud, 2024). Meanwhile, data visualisation, which is performed after the completion of audit work, aids auditors in gaining valuable insights, reaching accurate conclusions, and improving the audit process by transforming data into visual representations and effectively combining information from different dimensions (Alawadhi, 2015; Mauludina et al., 2024; Xing et al., 2020). Nevertheless, a literature gap regarding the current level of auditors' digital skills among auditors. Limited research was conducted on the actual extent of data analytical tools and types utilised by auditors in accomplishing audit tasks.

3.0 Methodology

The present employed two (2) methods, namely an online survey questionnaire and a focus group discussion, for data collection. A survey questionnaire was developed based on instruments derived from prior scholars (Bahador & Haider, 2013; Barr-Pulliam et al., 2022; Richardson et al., 2023), with several additional questions included to effectively accomplish the study objectives. The questionnaire comprises two (2) sections, with Section A focusing on respondents' demographic profiles and Section B appraising digital skill proficiency, data mastering and visualisation skills, and the usage of data analytics types and tools. The researchers utilised Google Forms, which was an online survey administration tool, to administer the survey questionnaire to efficiently and effectively collect, store, and visualise data. The Google Form was also cost-effective (Nayak & Narayan, 2019). The questionnaire was pre-tested to assess the comprehensibility of the questions among the top management and accounting lecturers of the BPAD. The survey respondents were 124 internal auditors from the BPAD, with the high response rate obtained through the effective collaborative effort between researchers and the appointed BPAD staff to disseminate the survey to auditors. The data collected from the survey were analysed through the SPSS statistical package. Specifically, the descriptive statistics of the mean score, standard deviation, and mean score ranking were analysed to quantitatively summarise the results. The SPSS statistical package was selected due to the user-friendly interface, robust statistical capabilities, and widespread acceptance among academic and professional researchers. The focus group discussion with four (4) top management members of the BPAD was conducted to support the findings from the survey questionnaire. The session lasted for three (3) hours and was attended by the Deputy Director of the Special Auditing Section, Deputy Director of the Operation Section, Deputy Director of the Asset and Inventory Accounting Compliance Unit, and Chief Assistant Director of the Quality Control and Risk Management Unit. The interview transcript was analysed via thematic analysis, with relevant quotes extracted to provide insights into auditors' digital skill proficiency and data analytical usage.

4.0 Results and Discussion

4.1 Respondents' Demographic Profiles

Table 1 depicts respondents' demographic profiles, wherein the majority are females and the largest age group is between 31 and 40 years old. Most respondents possessed either an Sijil Tinggi Persekolahan Malaysia (STPM) or Diploma or a Bachelor's degree. Above half of the respondents were assistant accountants, followed by 33% as accountants in various positions. A majority were employed for 11 to 15 years, followed by employed for 16 to 20 years. More than one-third of the respondents possessed experience working with audit-related work in the private sector before joining the public sector. Specifically, the majority with private-sector experience possessed below five (5) years of working experience.

| Category | Tablec1;pRespondents | 'Demographic _y Pro ile | Percentage (%) |
|-------------------------------------|---------------------------------|-----------------------------------|----------------|
| Gender | Female | 91 | 73.4 |
| | Male | 33 | 26.6 |
| | Total | 124 | 100.0 |
| | 20-30 | 7 | 5.6 |
| | 31-40 | 58 | 46.8 |
| Age (years old) | 41-50 | 51 | 41.1 |
| | 51-60 | 8 | 6.5 |
| | Total | 124 | 100.0 |
| | STPM / Diploma | 58 | 46.7 |
| | Bachelor's Degree | 56 | 45.2 |
| Educational Level | Master's Degree | 5 | 4.0 |
| | Professional Qualification | 4 | 3.2 |
| | Others | 1 | 0.8 |
| | Total | 124 | 100.0 |
| | Deputy Director | 3 | 2.4 |
| | Chief Assistant Senior Director | 6 | 4.8 |
| | Chief Assistant Director | 4 | 3.2 |
| Current | Senior Assistant Director | 10 | 8.1 |
| AGD | Assistant Director | 18 | 14.5 |
| | Assistant Accountant | 76 | 61.3 |
| | Others | 7 | 5.6 |
| | Total | 124 | 100.0 |
| | 1-5 | 15 | 12.1 |
| Employment | 6-10 | 8 | 6.5 |
| Years as a Government Officer | 11-15 | 44 | 35.5 |
| | 16-20 | 43 | 34.7 |
| | Over 20 | 14 | 11.3 |
| | Total | 124 | 100.0 |

| Category | Description | Frequency | Percentage (%) |
|---|------------------|-----------|----------------|
| Years of Experience in the Private Sector Related to Audit Work | No experience | 77 | 62.1 |
| | Less than 1 year | 20 | 16.1 |
| | 1-5 | 21 | 16.9 |
| | 6-10 | 5 | 4.0 |
| | 11-15 | 1 | 0.8 |
| | Total | 124 | 100.0 |
| | Less than 1 year | 19 | 15.3 |
| | 1-5 | 58 | 46.8 |
| Years of Experience | 6-10 | 27 | 21.8 |
| in the Public Sector Related to Audit Work | 11-15 | 9 | 7.3 |
| | 16-20 | 8 | 6.5 |
| | Over 20 | 3 | 2.4 |
| | Total | 124 | 100.0 |

 Table 1: Respondents' Demographic Profile (continued)

4.2 Digital Skill Proficiency Level

The respondents were asked to indicate the perceived proficiency degree in 11 digital skills on a five-point Likert scale ranging from 1 as very low proficiency to 5 as very high proficiency. Table 2 illustrates the mean scores, standard deviations, and mean score ranking for each of the digital skills measured. The mean scores ranged from 2.83 to 3.19, which posited that auditors were moderately proficient in the digital skills. The top three (3) digital skills acquired by auditors were spreadsheet software (mean = 3.19), presentation software (mean = 3.18), and advanced word processing for report preparation (mean = 3.13). The applications proficiently employed by auditors in Microsoft Office Excel, Word, and PowerPoint, which were considered one of the most crucial professional skills for future auditors (Aryanti & Adhariani, 2020; Uyar & Gungormus, 2011). Spreadsheet software, including Microsoft Excel, was utilised by BPAD auditors for data analysis as the software enabled auditors to audit the entire population. Presentation software, including Microsoft PowerPoint, was also commonly utilised for seminars, workshops, and training presentations. Furthermore, advanced word processing was widely employed for reporting audit findings and writing audit reports. The widespread usage of Microsoft Office applications in governmental administration was also discerned by Ahmi et al. (2016), who discovered a vast majority of auditors in the Internal Audit Unit (IAU) employed the applications for audit works. The extensive usage of the applications among BPAD auditors could also be attributed to the extensive availability as the AGD subscribed to Microsoft Office 365. Comparatively, the three lowest digital skills acquired by auditors were workflow automation and business process reengineering, record life cycle management, and database operations. The skills were integral to digital transformation and low proficiency propounded that the auditors were unprepared for the digital transformation. The BPAD is currently in the initial phase of fully digitalising audit processes, which might explain why the skills are a lower priority contemporarily. In addition, the low ranking of workflow automation and business process reengineering skills could be owing to organisational change resistance. Implementing the skills requires significant shifts in established audit workflows that challenge traditional processes and roles.

| Digital Skills | Mean | Standard Deviation | Rank |
|---|------|--------------------|------|
| Spreadsheet software | 3.19 | 0.85 | 1 |
| Presentation software | 3.18 | 0.89 | 2 |
| Advanced Word document for report preparation | 3.13 | 0.85 | 3 |
| Information search and retrieval techniques | 3.06 | 0.82 | 4 |
| IT governance (resource management, risk management, performance management, value delivery, and strategic alignment) | 2.98 | 0.95 | 5 |
| IT security (antivirus system, firewall, backup, and recovery) | 2.98 | 0.93 | 6 |
| Data analysis, reporting, querying, and business intelligence | 2.91 | 0.94 | 7 |
| Data auditing (audit trail, fraud control, and others) | 2.91 | 0.91 | 8 |
| Database operations (data creation, manipulation, management, coding, dictionary, control, extraction, and warehouse) | 2.90 | 0.92 | 9 |
| Record lifecycle management (creation exchange, storage retrieval, and retirement or deletion) | 2.85 | 0.93 | 10 |
| Workflow automation and business process reengineering | 2.83 | 0.91 | 11 |

Table 2: Digital Skill Proficiency Levels among Auditors

4.3 The Degree of Data Mastering and Visualisation Skill Proficiency

Data management, cleansing, and correcting skills are considered crucial by the auditing industry (Holmes & Douglass, 2022). Specifically, respondents were asked to indicate the proficiency level in four (4) key areas, namely data extraction, data loading, data transformation or cleaning, and data visualisation through a five-point Likert scale to assess respondents' proficiency in data mastering and visualisation skills. Table 3 depicts the mean scores range from 2.8 to 2.92, which posits moderate proficiency. Particularly, data extraction was employed the most while data visualisation was the least utilised among auditors based on mean score ranking. Preparing datasets for analysis was also one of the highest challenges in data analytics due to the complex processes (Krishnan et al., 2016). The initial step in preparing data for analysis was data extraction in the ETL process, followed by data transformation and loading (Richardson et al., 2023). Hence, data extraction was the highest-ranked skill among the auditors as extracting data from the iGFMAS enabled auditors to automatically execute scripted analyses and pinpoint any potential anomalies or red flags within the dataset. The data cleaning process was performed after the data were extracted from the iGFMAS. The dataset was examined and corrected for incorrect values, missing data, and duplicates before being loaded into the selected tools, namely either Microsoft Excel or ACL:

"ACL operates within the raw data of iGFMAS... ACL mainly deals with raw data, totally raw data, tables, and tables within iGFMAS. It extracts data from various tables and performs analyses." (M4)

The data visualisation skill was ranked last. Data visualisation involves transforming data into visual representations that can effectively amalgamate information from various dimensions (Xing et al., 2020) while facilitating cognitive processes, especially in a big data environment, to assist auditors in increasing vigilance and efficiency (Mauludina et al., 2024). The last rank of

the digital skill among auditors postulated that data visualisation was employed less frequently compared to other data mastering skills. A systematic review conducted by Mauludina et al. (2024) highlighted the limited application of data visualisation in auditing despite the potential to improve audit quality.

| Data Mastering and Visualisation Skills | Mean | Standard Deviation | Rank |
|---|------|--------------------|------|
| Data extraction | 2.92 | 0.98 | 1 |
| Data loading | 2.85 | 1.07 | 2 |
| Data transformation or cleaning | 2.85 | 1.00 | 3 |
| Data visualisation | 2.80 | 0.98 | 4 |

Table 3: Data Mastering and Visualisation Skill Proficiency among Auditors

4.4 Usage of Data Analytics Types and Tools

Data analytics is one of the digital auditing components (Pilos, 2020). The current study assessed the level of data analytics usage among auditors in two (2) aspects, namely (1) data analytics types and (2) data analytical tools, on a five-point Likert scale ranging from 1 as not at all to 5 as very extensive. Table 4 demonstrates that the mean score for each types ranges from 2.78 to 2.82, which posits that the auditors employ the data analytics types moderately. The mean score rankings indicated that predictive and descriptive analytics were the most commonly employed types. This finding aligned with the ongoing efforts of the BPAD to digitalise audit processes and reflect broader trends in the auditing field. Kuenkaikaew and Vasarhelyi (2013) underscored that audit automation facilitated more proactive and predictive auditing, which enabled auditors to detect anomalies and assess risks in real time. Descriptive analytics, which involves summarising and visualising audit data through graphs, charts, and dashboards, remains fundamental in audit analytics. The types is straightforward and highly comprehensible, particularly for junior auditors who may not possess extensive experience with more advanced types. Conversely, prescriptive analytics was the least utilised data analytics types among internal auditors, which required auditors to not only perform predictions but also recommend actionable solutions. Therefore, the auditing process is inherently intricate (Sigma, 2021). Furthermore, the involvement of top management is integral to strategic decisions. The high adoption rate of data analytics types among the respondents, in which approximately 70% were assistant auditors, suggested a high focus on data representation instead of strategic decision-making. Table 5 also portrays that only Microsoft Excel is extensively employed by auditors, whereas other data analytical tools, particularly ACL, Microsoft Power BI, and Tableau, are moderately utilised. Summarily, the results highlighted the evolving role of data analytics in auditing processes. While predictive and descriptive analytics are more prevalent due to accessibility and practical benefits, prescriptive analytics requires further institutional support and capability development to achieve widespread adoption in the audit profession.

| | 0 | | 0 | |
|----------------------|---|------|--------------------|------|
| Data Analytics Types | | Mean | Standard Deviation | Rank |
| Predictive | | 2.82 | 0.991 | 1 |
| Descriptive | | 2.82 | 0.991 | 2 |
| Diagnostic | | 2.81 | 0.985 | 3 |
| Prescriptive | | 2.78 | 0.992 | 4 |

Table 4: Usage of Data Analytics Types among Auditors

Table 5: Usage of Data Analytical Tools

| Data Analytics Tools | Mean | Standard Deviation | Rank |
|----------------------|------|--------------------|------|
| Microsoft Excel | 3.62 | 0.850 | 1 |
| ACL | 2.61 | 1.167 | 2 |
| Microsoft Power BI | 2.32 | 1.159 | 3 |
| Tableau | 2.23 | 1.155 | 4 |

The extensive usage of Microsoft Excel could be owing to the substantial training provided by the BPAD to auditors:

"In BPAD, a few years back, we started training our auditors with the basics, using Excel, and advanced Excel – everything related to Excel. This served as a stepping stone for us to move to the next level. We learned how to analyse data using Excel, which is semi-automatic and manual. Once we understood Excel, we could progress to other tools." (M4)

The predominant role of ACL as the primary audit tool in the BPAD explained the second rank, which allowed auditors to plan and complete more thorough, accurate, and efficient audits (Felski, 2023):

"As for the audit tools, we are using ACL. We have experts in ACL, whom to construct scripts for components... We also have appointed a vendor to assist us in building ACL scripts." (M3)

Microsoft Power BI and Tableau garnered low rankings due to the limited suitability for auditing purposes:

"Power BI is good, but for auditing, ACL is still better. ACL specialises in auditing.... Tableau's visualisation dashboard is attractive, but when it comes to auditing, ACL has its own strengths...Furthermore, Tableau is expensive, though it's the best. However, due to the high cost, we had to pull the handbrake." (M4)

In addition, both Microsoft Power BI and Tableau were utilised for data visualisation. The low usage was partially consistent with previous findings that auditors were discovered to possess the least proficiency in data visualisation.

5.0 Implications, Limitations, Recommendations for Future Research and Conclusion

Public-sector auditors should develop digital proficiency and data analytical skills to resolve current challenges as digital transformation in auditing becomes increasingly necessary to the national commitment to embracing digitalisation. The findings revealed that BPAD auditors were moderately proficient in digital skills and data analytics types were moderately utilised. While Microsoft Excel was extensively employed, other tools were moderately utilised. In addition, the results corroborated that a successful digital audit implementation required auditors to enhance the proficiency degree in data analytical skills and types. Hence, the BPAD should consider developing training modules with an extensive coverage of IT and digital skills, including database operations and data analytics. Regular training and workshops related to digital audit could also be offered both internally and externally to auditors. Furthermore, trainers' sharing sessions and training programmes could motivate the immediate application of the knowledge and skills acquired from the workshops. One feasible approach is microcredentialing, wherein auditors can complete short and specialised courses focusing on specific data analytical tools and types. The modular programmes allow for flexible and selfpaced learning, which enables auditors to upskill without disrupting existing work commitments. Another approach is professional certification programmes, such as Data Analytics for Auditors certification, which can offer auditors industry-recognised credentials and improve auditing competencies and credibility. While the results uncovered that auditors accomplished significant progress in the necessary groundwork within respective jobs to structure the digital audit within the department, low proficiency levels were discovered in data mastering and visualisation skills and data analytics types. Auditors should consider acquiring alternative skills in AI and ML to be capable of performing prescriptive analysis based on a model developed through predictive analytics, which is beyond descriptive and diagnostic analytics. Acquiring alternative skills could also assist the auditors in becoming valuable contributors to strategic decisionmaking, especially when most audit work in the BPAD relies on the ACL software. Therefore, ensuring that more staff are fully trained and competent is pivotal.

The current study contains several limitations despite the significance of the findings. Specifically, this study collected data on self-reported proficiency levels, which might introduce response bias due to over- or underestimation of skills by respondents. Auditors might perceive personal digital capabilities differently based on personal confidence levels or prior exposure to training, which could impact the accuracy of the findings. The present study also focused only on the BPAD auditors of the AGD. Involving auditors from the National Audit Department (NAD) of Malaysia is also vital to thoroughly understanding public-sector auditors' digital proficiency and usage levels of data analytical instruments as the NAD is also the primary entity responsible for auditing all other public-sector entities. Future scholars can also consider comparing both BPAD and NAD on various implementation aspects and identifying the potential synergistic collaborations between the two (2) entities to improve auditors' digital proficiency and achieve optimal usage of data analytics. Furthermore, future academicians can adopt a longitudinal approach to assess improvements in auditors' digital skills in the long term or incorporate inferential statistical analysis to scrutinise the relationships between auditors' digital proficiency and the adoption rate of data analytics. Employing techniques, such as regression analysis or structural equation modelling, can offer deeper insights into the factors contributing to data analytical usage. Summarily, the empirical evidence from this study could support attaining the primary objective of accelerating the digital transformation agenda of the government through digital audit technological advancements.

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